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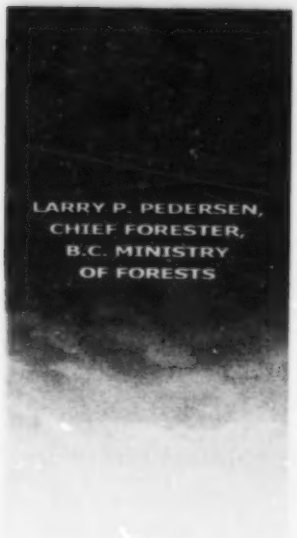
Message from the Chief Forester



LARRY P. PEDERSEN,
CHIEF FORESTER,
B.C. MINISTRY
OF FORESTS

I am pleased to participate in the publication of this first Forest Genetics Council annual report. Thanks to the efforts of Council and its many cooperators, and to the ongoing support of Forest Renewal BC, this report introduces annual reporting on the performance goals and measures in place for the provincial forest gene resource management program.

I'm particularly pleased with the progress in communications and extension, and in gene conservation over this past year. These activities will help to further Council's strategic goal and objectives.

I believe that tree improvement remains one of the better ways to enhance forest productivity in British Columbia, and that seed orchards are the "engine" that powers tree improvement. It's important to get the message out that these orchards produce natural seed directly from our best-performing native trees. There are no genetically engineered materials in British Columbia's licensed seed orchards or in the seed derived from these seed orchards, and no genetically modified trees are used for Crown land reforestation programs in the province.

Stewardship of the existing tree genetic diversity is key to intelligent management of the genetic resource. Partnering with the University of British Columbia in gene resource management is an exciting step forward and I look forward to much progress in this area.

I note with satisfaction the increased sophistication of the provincial seed planning information management system. New initiatives will improve the use of seed planning information in silviculture planning and timber supply forecasting. New Web-based mapping tools will improve client access to tree improvement planning information, including projections of orchard production and genetic gains.

This report demonstrates the Forest Genetics Council's accomplishments in planning and coordinating resources for provincial seed orchard expansion and development. It represents an important milestone for tree improvement in British Columbia. This progress would not have happened without the strong and collaborative support of Forest Renewal BC, universities, the coastal and interior forest industries, and the Ministry of Forests.

Message from Forest Genetics Council Co-Chairs

SHANE BROWNE-CLAYTON
INDUSTRY CO-CHAIR

DALE DRAPER
MINISTRY OF FORESTS
CO-CHAIR

Thanks to the commitment of industry, government, universities, and Forest Renewal BC, British Columbia has strong leadership, clear objectives, inclusive planning processes, solid funding, and performance-based management systems for a provincial forest gene resource management program.

During the 2000/01 fiscal year, substantial progress was made in several areas:

- *Gene conservation received a boost with the announcement of a Forest Renewal BC-funded Centre for Forest Gene Conservation at the University of British Columbia. This Centre will assist with the continued development of forest practices that safeguard the forest genetic resource.*
- *Forest Renewal BC concluded an agreement with SelectSeed Company Ltd. to fund the expansion of existing, and the establishment of new seed orchard capacity to meet Council's long-term objectives. Council controls SelectSeed, which is cooperatively owned under the Forest Genetics Society.*
- *Performance indicators to track planning and report progress at the project level were introduced at the urging of Forest Renewal BC.*

As well, the average genetic worth of select seed and rooted cuttings requested for reforestation in British Columbia rose to 7.9%. Select seed use was 37% of total provincial sowing, a modest increase over previous years. While on track with Council's 1998 Strategic Plan, select seed use is still a significant distance from Council's objective of 75% use by 2007.

Tree improvement is one of British Columbia's best silvicultural investments – the cost of select seed per hectare planted is relatively low and the return in increased wood volume production is significant. The production benefits of tree improvement are now routinely incorporated into the determination of allowable annual cuts, and are also finding their way into the development of Resource Management Plans, Innovative Forestry Practices Agreement Forestry Plans, and Incremental Silviculture Strategies.

As Forest Genetics Council Co-Chairs, we are enthusiastic about the progress made during 2000/01, and look forward to continued cooperation and advancement in the coming year.

1.0 Forest Gene Resource Management in British Columbia

Forest gene resource management includes the conservation, controlled use, and enhancement of genetic resources of forest tree species.

Forest gene resource management encompasses the conservation, controlled use, and enhancement of genetic resources of forest tree species, and related communication and extension activities.

Forest gene resource management is a cooperative effort. The Forest Genetics Council of British Columbia (FGC, Council) coordinates a provincial forest gene resource management program that is implemented by stakeholders in the forest industry, Ministry of Forests (MOF), Canadian Forest Service (CFS), and universities.

Forest Renewal BC is the major funding agency for forest gene resource management in British Columbia. Industry, MOF, and university cooperators contribute substantial in-kind, staff, and other resources.

This annual report describes progress on work outlined in the FGC Business Plan 2000/2001. Most of this work is funded through the Forest Renewal BC Tree Improvement Program (TIP), which takes direction from Council's strategic and annual business plans.

The report consists of five main sections. Section 1 presents an overview of the Forest Genetics Council and Forest Renewal BC TIP. Section 2 reports budgets, expenditures, and progress in Forest Renewal's TIP by key performance indicators. Section 3 describes provincial progress indicators. Section 4 summarizes cooperator activities. Section 5 highlights challenges facing Council in the year ahead.

This report describes progress on work described in the Forest Genetics Council of B.C. Business Plan 2000/2001.

1.1 Forest Genetics Council of BC

> *The Forest Genetics Council represents the B.C forest industry, Ministry of Forests, universities, and Forest Renewal BC.*

The FGC is a multi-stakeholder group representing the forest industry, MOF, universities, and Forest Renewal BC. Council's mandate is to champion forest gene resource management, to oversee strategic and business planning for a cooperative provincial forest gene resource management program, and to advise the province's Chief Forester on policies related to forest gene resource management.

The Council provides a forum for stakeholder representatives to set goals and objectives, and to oversee the development and delivery of business plans to fulfill them.[1]

As set out in its 1998 Strategic Plan, Council's goal is:

To maximize the economic benefits from tree improvement investments for gains in wood quality, quantity and pest tolerance consistent with strategic land use planning by:

- *managing a gene conservation program to maintain genetic diversity in commercial tree species*
- *identifying and funding the long-term production capability required to meet approved Business Plan priorities*
- *doubling the average volume gain of select[2] seed produced from 6% to 12% by 2007*
- *increasing select seed use to 75% of total provincial sowing by 2007*
- *monitoring progress in all aspects of gene resource management.*

> *Council's Technical Advisory Committees lay the groundwork for the annual FGC Business Plan.*

Business Planning

The annual FGC Business Plan outlines the activities and budgets of the seven subprograms that constitute the provincial forest gene resource management program.

FGC Technical Advisory Committees (TACs) provide technical and policy information to Council and contribute to the development of annual plans and associated budgets to achieve FGC goals and objectives (Figure 1):

- The Gene Conservation TAC (GCTAC) advises Council on issues related to gene conservation and genetic diversity, and identifies required activities and budgets.

[1] For more information on the Forest Genetics Council, see *http://www.fgcouncil.bc.ca/*

[2] "Select" describes seed and vegetative material having a level of genetic gain (GW > 0). All seed and vegetative lots derived from orchards and production facilities (genetic Class A) and superior provenances (genetic Class B+) are considered select seed sources.

- The Coastal and Interior TACs, through their Species Committees, prepare Species Plans that estimate seed demand, production capacity, and genetic gain for each of the 42 seed planning units (SPUs)[3] in the provincial forest gene resource management program.
- The Extension TAC (ETAC) advises Council on communication and extension issues, and develops an annual activity plan for extension and communication activities.

Each TAC identifies priorities and evaluates and ranks proposals for funding through the Business Plan. Council reviews all strategies, plans, or recommendations from the TACs or other agencies for approval (or revision) before incorporating them into the FGC Business Plan.

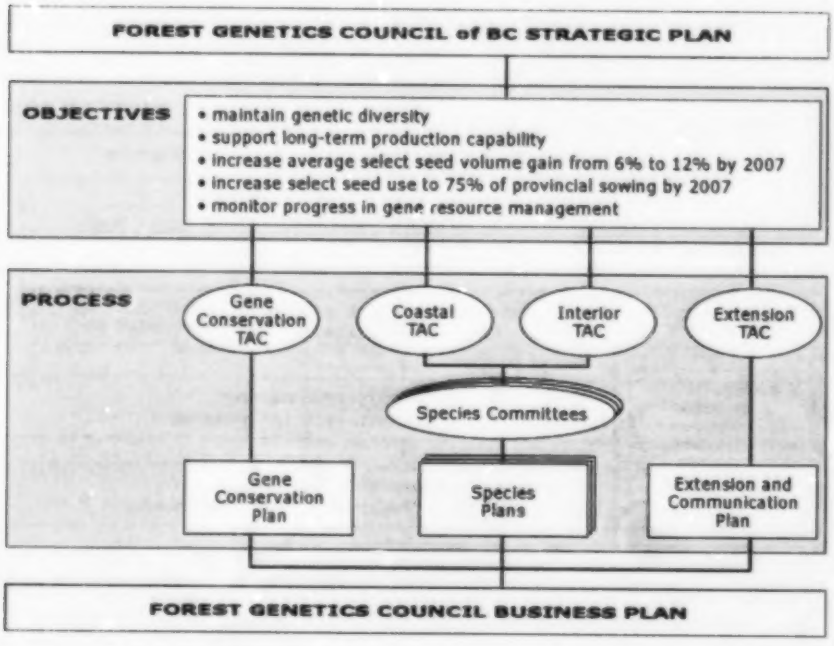

FOREST GENETICS COUNCIL of BC STRATEGIC PLAN
OBJECTIVES
• maintain genetic diversity
• support long-term production capability
• increase average select seed volume gain from 6% to 12% by 2007
• increase select seed use to 75% of provincial sowing by 2007
• monitor progress in gene resource management
PROCESS
Gene Conservation TAC
Coastal TAC
Interior TAC
Extension TAC
Species Committees
Gene Conservation Plan
Species Plans
Extension and Communication Plan
FOREST GENETICS COUNCIL BUSINESS PLAN

Figure 1
The link between FGC objectives, planning processes, and the FGC Business Plan.

[3] Seed planning units are groupings by species, seed zone, and elevation band. They are logical units for the planning and management of tree breeding and seed production. Appendix 1 lists the 42 SPUs in the provincial forest gene resource management program that are targeted for investment in genecology, breeding, and orchard development.

1.2 Forest Renewal BC Tree Improvement Program

"Forest Renewal's Tree Improvement Program seeks to increase seedling growth rate, wood quality, and pest resistance, and preserve tree species genetic diversity."

The Forest Renewal BC Tree Improvement Program (TIP) seeks to increase the growth rate, wood quality, and pest resistance of seedlings, and to preserve the genetic diversity of tree species across the province. Through its TIP, Forest Renewal BC invests in forest gene resource management activities that support its objectives and are incremental to existing government and industry activities.

TIP activities are organized into seven subprograms (Figure 2):[4]

- Gene Conservation
- Tree Breeding
- Operational Tree Improvement (OTIP)
- Expansion of Orchard Seed Supply (SelectSeed Ltd.)
- Extension and Communication
- Seed Planning and Information Tools
- Administration.

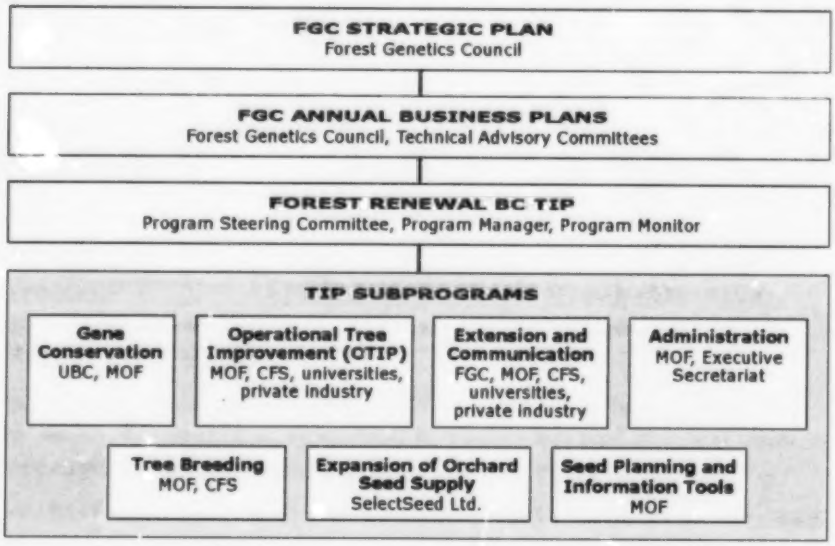


Figure 2
Relationship between FGC strategic and annual business plans, and Forest Renewal BC TIP; participants in various forest gene resource management activities.

[4] Council's Business Plan and Forest Renewal's TIP are organized with the same subprogram structure.

Funding

TIP funds are allocated through a 10-year program management plan related to the FGC Strategic Plan. Annual budget allocations are based on recommendations from the FGC Business Plan, subject to Forest Renewal BC budgeting processes and approvals.

During the 2000/01 fiscal year, the Forest Renewal BC TIP funded forest gene resource management activities identified in the FGC Business Plan through three administrative mechanisms:

- Forest Renewal BC/UBC Contribution Agreement
- Forest Renewal BC/MOF Goals Agreement
- Forest Renewal BC/SelectSeed Company Ltd. Contribution Agreement.

The TIP subprograms associated with each of the agreements are shown in Figure 3.

> *"TIP annual budgets are based on recommendations from the Forest Genetics Council Business Plan."*

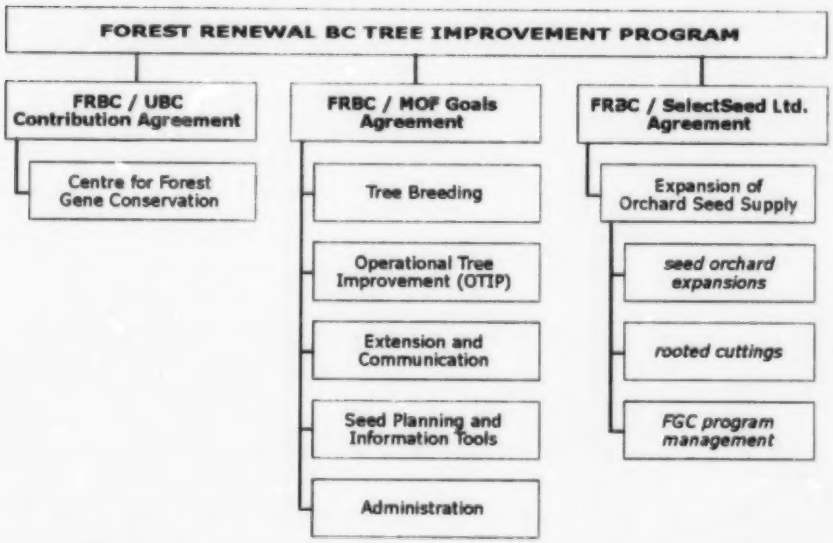


Figure 3
Funding agreements for the delivery of Forest Renewal BC TIP.

> *TIP activities are monitored for performance and progress towards long-term program objectives.*

Monitoring and Reporting

TIP subprogram activities are monitored for performance relative to specified criteria, and for progress towards long-term program objectives. Performance is planned, monitored, and reported using key performance indicators (KPI). These indicators are logical measures of work such as "number of grafts made" or "number of ramets planted." The types of work done under each subprogram are organized under a work breakdown structure (WBS) shown in Figure 4.[5] KPI are not feasible for all types of work, and reports are written for technical support, gene conservation, extension, communication, and administrative activities.

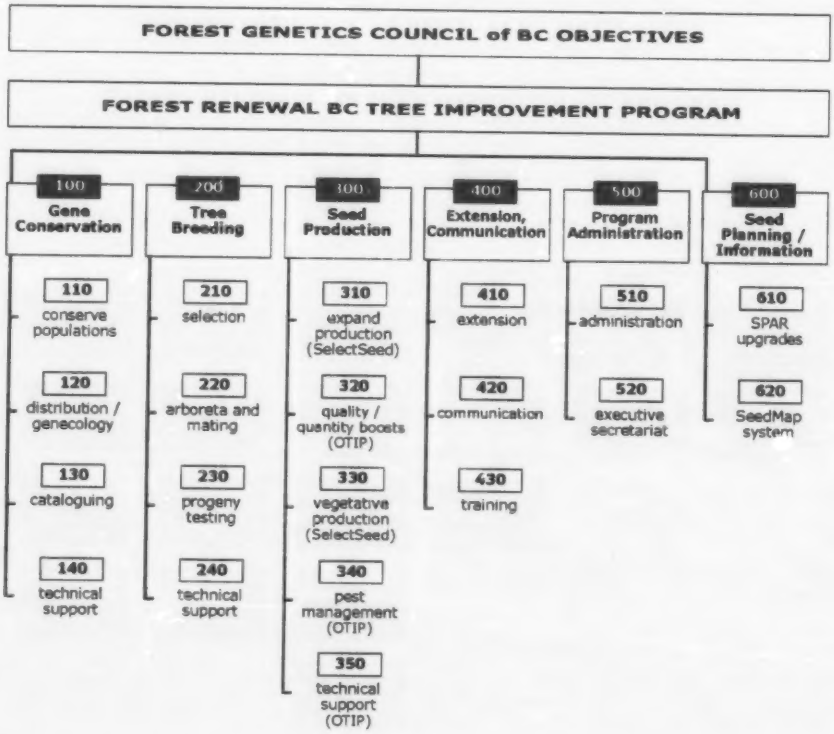


Figure 4
Work breakdown structure for program organization, management, and monitoring.

[5] This WBS is expanded in the FGC Business Plan 2001/2002.

2.0 Forest Renewal TIP Progress 2000/01

2.1 Budgets and Expenditures

Forest Renewal BC TIP financial allocations and expenditures for the 2000/01 fiscal year are shown in Table 1. The table does not include the in-kind, staff, and other substantial inputs by industry, MOF, and university cooperators that contribute to the success of the Tree Improvement Program.

Table 1
Summary of Forest Renewal BC TIP subprogram budgets, expenditures for April 1, 2000 through March 31, 2001.

Subprogram	Budget ($)	Expenditures ($)
Gene Conservation	183 700	183 700
Tree Breeding	2 350 000	2 238 283
Operational Tree Improvement (OTIP)	1 545 000	1 426 892
Expansion of Orchard Seed Supply (SelectSeed Ltd.)	4 766 300*	368 031
Extension and Communication	170 000	108 083
Seed Planning and Information Tools	275 000	274 966
Administration	365 000	363 849
Forest Renewal BC TIP Contribution	**$9 655 000**	**$4 963 804**

*Approximately $4 400 000 was placed in a long-term fund to support orchard development.

2.2 Gene Conservation Subprogram

Gene conservation activities protect the gene pool needed for species to adapt to future environmental conditions, and ensure that genetic resources are maintained for future generations.

During 2000/01, a 7-year Gene Conservation Plan was initiated with the inauguration of the Centre for Forest Gene Conservation (CFGC) at UBC. The CFGC will bring together expertise on forest genetics and conservation to explore issues in gene conservation, develop conservation strategies, evaluate needed versus current levels of protection of genetic diversity, and carry out fundamental research on genetic diversity in native species. The Centre will also advise the FGC on specific matters relating to the conservation of genetic diversity in British Columbia's forests.

Forest Renewal BC is funding the first two years of activities in the plan through a Contribution Agreement with UBC. The Centre, in conjunction

> *"Gene conservation activities ensure that genetic resources are maintained for future generations."*

with Council's GCTAC, will develop annual activity plans for gene conservation. Three projects were started in 2000/01:

- a technical strategy for forest gene conservation in British Columbia
- study of genecology and population genetic structure of whitebark pine (*Pinus albicaulis*)
- sampling strategies for capture of diversity and conservation of rare alleles in B.C. tree populations.

2.3 Tree Breeding Subprogram

"The Tree Breeding Subprogram seeks to continually improve the genetic worth[6] of seed and vegetative materials for reforestation."

Tree breeding activities include selecting parents in wild stands, propagating, testing offspring, mating, establishing/maintaining/measuring trials, and delivering technical support. The Tree Breeding Subprogram includes applied genecology to support the information needs of SPU programs as described in Species Plans. FGC Interior and Coastal TACs and associated Species Committees carry out planning for the subprogram. The MOF Research Branch manages and undertakes subprogram activities.

Figure 5 indicates the allocation of effort to Tree Breeding Subprogram activities in 2000/01. Figure 6 compares the work completed under each activity to work planned for the fiscal year.

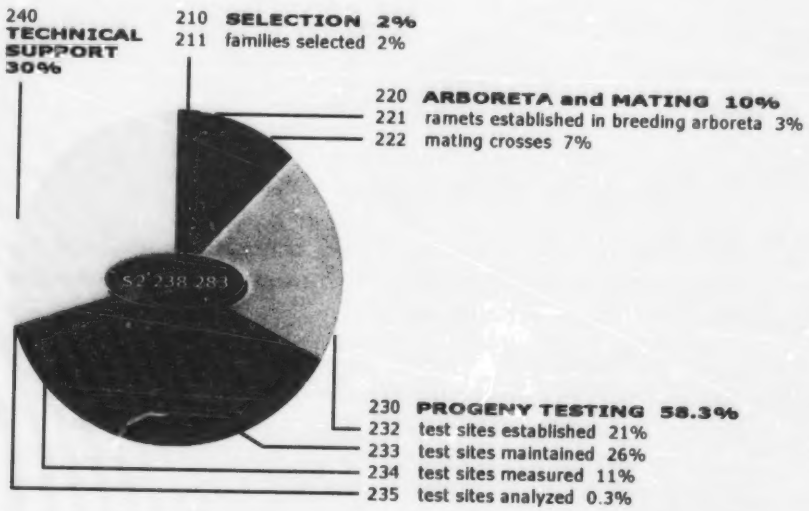


Figure 5
Tree Breeding Subprogram funding allocation 2000/01.

[6] Genetic worth (GW) is a measure of the genetic quality of a seed or vegetative lot over wild stand material, measured for a specific trait (e.g., growth, wood density, pest resistance).

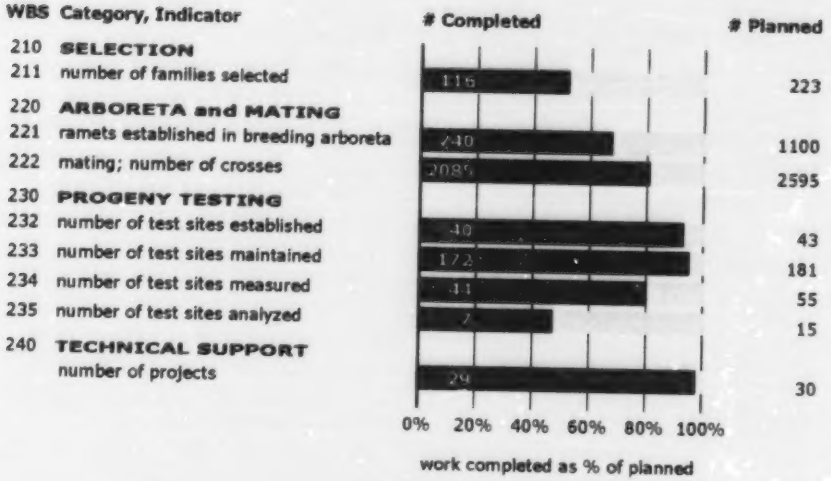


Figure 6
Tree Breeding Subprogram progress 2000/01.

Selection

Families selected from progeny tests supply orchard and breeding populations with trees capable of producing seed of higher genetic worth.

WBS 211: 52% of families were selected as planned. Families for SPU *Hw M low* sites will be selected when analyses of progeny test measurement data are completed.

Arboreta and Mating

Breeding arboreta provide archives of selected trees that are used for controlled matings or for the production of small high-gain seedlots. Controlled matings among selected trees supply the seed needed for progeny testing advanced populations and for research activities.

WBS 221: All available ramets were established in breeding arboreta. The 33% shortfall in planned establishment was due to relocating and subsequently delaying establishment of a planned coastal white pine breeding arboretum, and to fewer than expected available ramets for planting in a Sitka spruce arboretum.

WBS 222: The 20% shortfall in controlled matings was due to lower than anticipated flower production in several species, principally hemlock. The number of controlled matings is often difficult to estimate because of unpredictable flower production. Within this category, work performed differed substantially from work planned to take advantage of flowering in breeding arboreta and orchards.

Breeding arboreta provide archives of selected trees that are used for controlled matings or for the production of small high-gain seedlots.

> *Progeny tests provide information on parent tree performance.*

Progeny Testing

Progeny tests are established to give information on the performance of selected parent trees. This information is used to calculate breeding values and to select new orchard and breeding populations. Ongoing maintenance of field test sites includes tree identity tagging, brushing, sign maintenance, and other activities to ensure long-term integrity of data and records. Data from tests sites are analyzed using quantitative genetics models to estimate breeding values and the stability of parent performance.

WBS 232: Most (93%) of the planned test sites were established. For two SPUs, planting projects were reduced by one test site due to design changes and stock reallocations.

WBS 233: 95% of the planned site maintenance was completed. A reallocation of effort to more intensively maintain a smaller number of high priority Sitka spruce sites resulted in fewer sites being maintained than planned.

WBS 234: 80% of planned test measurements were completed. The variance is attributable to a reallocation of resources from planned measurements on 10 interior white pine sites to intensive measurement and information collection on two coastal white pine progeny test sites.

WBS 235: 47% of the planned analyses were completed. The variance is due primarily to a delay in the analysis of data from five coastal hemlock progeny tests so that they could be combined with data from a second test series to be measured in 2001/02. Also, analysis of data from a series of interior white pine progeny tests was not completed, as the tests were not measured.

Technical Support

Technical support work includes adaptive trait testing, non-routine wood quality assessments, pest–host relationships, and other projects to advance breeding programs.

WBS 240: Some 29 technical support projects proceeded as planned, including realized-gain trials to better quantify gains in wood yield per hectare, and projects in wood quality, pest resistance, genecology, and adaptive traits such as frost hardiness. A grand fir (*Abies grandis*) coast provenance test assessment was deferred due to lack of human resources.

2.4 Operational Tree Improvement (OTIP) Subprogram

The OTIP Subprogram focuses on increasing the quality and quantity of Class A seed produced from existing forest company and MOF seed orchards. It also provides technical support for orchard production and management, including pest management.

"OTIP focuses on increasing the quality and quantity of seed produced from existing seed orchards."

OTIP spending is based on Species Plans – projects are developed through calls-for-proposals based on Species Plans priorities. FGC Review Committees rank all proposals against FGC objectives and SPU priorities, based on technical merit, impact, value, and cost. The MOF Tree Improvement Branch administers the OTIP on behalf of Forest Renewal BC and the FGC.

Figure 7 indicates the allocation of funding to OTIP Subprogram activities in 2000/01. Figure 8 compares the work completed under each activity to work planned for the fiscal year.

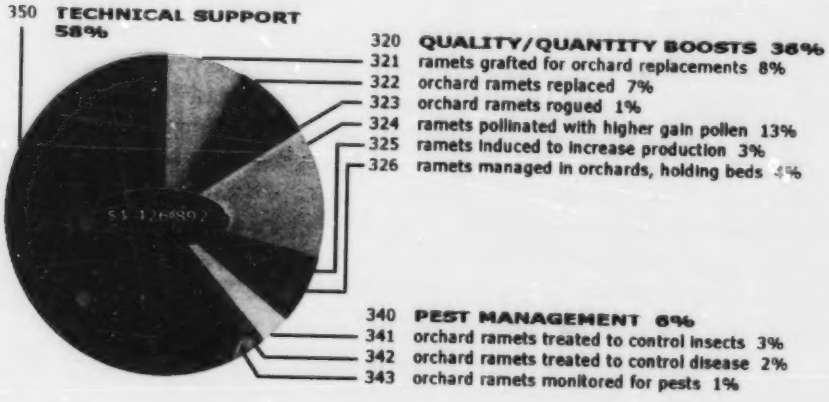

350 TECHNICAL SUPPORT
58%
320 QUALITY/QUANTITY BOOSTS 36%
321 ramets grafted for orchard replacements 8%
322 orchard ramets replaced 7%
323 orchard ramets rogued 1%
324 ramets pollinated with higher gain pollen 13%
325 ramets induced to increase production 3%
326 ramets managed in orchards, holding beds 4%
340 PEST MANAGEMENT 6%
341 orchard ramets treated to control insects 3%
342 orchard ramets treated to control disease 2%
343 orchard ramets monitored for pests 1%

Figure 7
OTIP Subprogram funding allocation 2000/01.

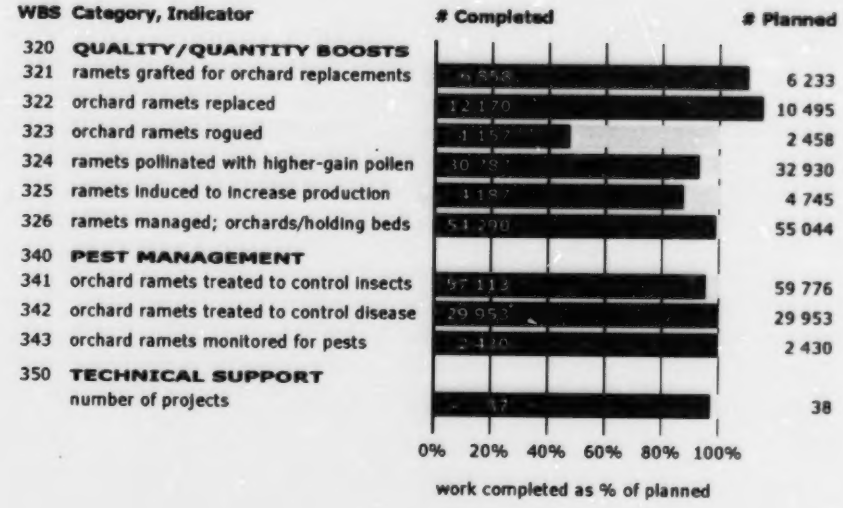


Figure 8
OTIP Subprogram progress 2000/01.

Techniques to improve the genetic quality and quantity of orchard seed include introducing new selections from breeding programs, using high quality pollen, and inducing ramets to produce more reproductive buds.

Quality/Quantity Boosts

Several techniques are used to improve the genetic quality or quantity of orchard seed. New selections from breeding programs are grafted for planting (one to two years after grafting) in seed orchards to replace the lower-gain ramets and improve the genetic worth potential of orchard seed. Supplemental mass pollination (SMP) and controlled pollination (CP) methods are used to apply high quality pollen to flowers to increase both seed production and genetic worth. Orchard ramets are induced through hormone treatments or girdling to produce more reproductive buds. Seed-orchard and holding-bed ramets are managed to control crown growth and weeds, and to maintain identities. The following progress was made on specific activities during 2000/01.

WBS 321: 10% more grafting was completed than planned due to better than expected rootstock quality.

WBS 322: 16% more orchard ramets were replaced than planned because the number of available grafted ramets exceeded estimates in project proposals.

WBS 323: Orchard roguing proceeded as planned, with one delay related to uncertainty regarding seed transfer limits for the *Sx Nelson* SPU.

WBS 324: 93% of planned SMP and CP projects were carried out. Some planned projects were not undertaken due to less than anticipated female cone production.

WBS 325: 88% of planned ramet inducement of reproductive buds was completed. Weather difficulties prevented inducements at the Skimikin orchard site.

WBS 326: Over 54 000 ramets in orchards and holding beds were managed to control crown growth and weeds and maintain identities.

Pest Management

Insects and disease can damage cones or reduce the vigour and cone production of orchard ramets. Treatments to control insects and disease are only undertaken when needed. Orchard ramets are monitored for pest problems for early detection and effective control.

WBS 341: Some 57 000 ramets were treated to control insects. Fewer insect problems required treatment than anticipated, partially due to lower than expected interior spruce crops.

WBS 342: Almost 30 000 ramets were treated to control disease.

WBS 343: Some 2430 ramets were monitored for insect and disease problems.

Technical Support

Seed orchard technical support projects are designed to remove barriers to producing high-quality seed for operational use.

WBS 350: Some 37 technical support projects addressed priority issues, including seed set problems in southern lodgepole pine orchards, pest control measures, pollen management to improve genetic worth and seed production, and orchard management techniques. One project examining disruption of white pine weevil mating did not proceed.

> *"Technical support projects investigate ways to improve the production of high-quality seed."*

2.5 Expansion of Orchard Seed Supply Subprogram (SelectSeed Ltd.)

Forest Renewal BC supports seed orchard expansions and the cooperative production of vegetative materials through SelectSeed Company Ltd. (SelectSeed), a corporation wholly owned by the B.C. Forest Genetics Society (Figure 9). SelectSeed's primary mandate is to support seed orchard expansions needed to meet FGC objectives. As SelectSeed is controlled by stakeholders and not aligned with any other single agency, it also supplies program management services to the FGC.

SelectSeed's Business Plan and investments are based on the long-term and annual business plans prepared by FGC TACs and Species Committees. Management discretion for spending lies with the SelectSeed Board of Directors,[7] and is guided by the Multi-Year Agreement between SelectSeed and Forest Renewal BC. Orchard development agreements are long-term contracts that give stability for investment and management. The FGC annually reviews and approves the SelectSeed Business Plan.

> *"SelectSeed's primary mandate is to support seed orchard expansions needed to meet FGC objectives."*

[7] The Board is comprised of representatives from the private sector and government, including the industry and government FGC Co-Chairs.

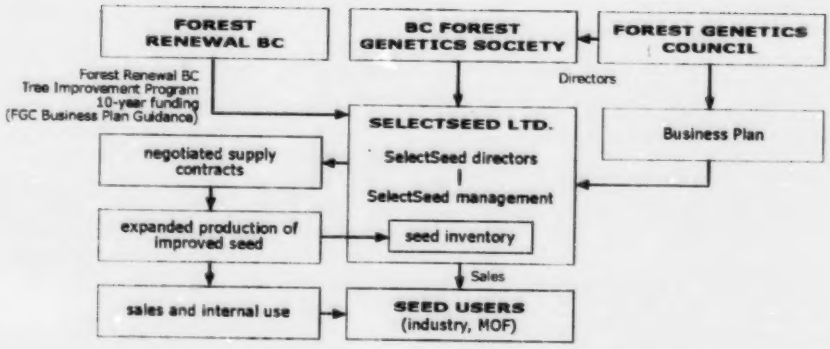


Figure 9
Organizational relationships between SelectSeed Ltd., Forest Renewal BC, Forest Genetics Council, and B.C. Forest Genetics Society.

Figure 10 indicates the allocation of funding to Expansion of Orchard Seed Supply Subprogram activities in 2000/01. Figure 11 compares the work completed under each activity to work planned for the fiscal year.

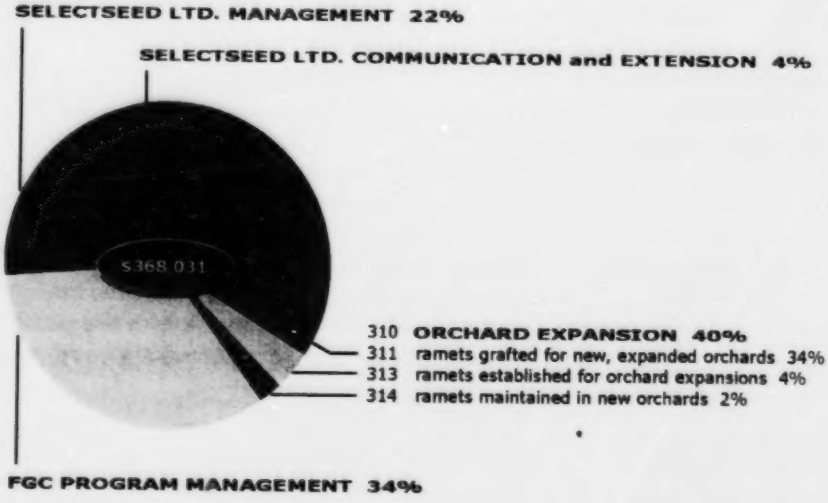

SELECTSEED LTD. MANAGEMENT 22%
SELECTSEED LTD. COMMUNICATION and EXTENSION 4%
$368 031
310 ORCHARD EXPANSION 40%
311 ramets grafted for new, expanded orchards 34%
313 ramets established for orchard expansions 4%
314 ramets maintained in new orchards 2%
FGC PROGRAM MANAGEMENT 34%

Figure 10
Expansion of Orchard Seed Supply Subprogram funding allocation 2000/01.

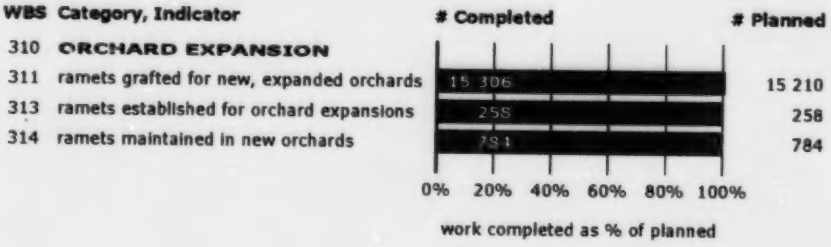


Figure 11
Expansion of Orchard Seed Supply Subprogram progress 2000/01.

Orchard Expansion

Grafting is used to propagate selected parent trees for establishment in seed orchards. Ramets grafted in previous years are transplanted to new orchard sites. Maintenance of ramets in orchards is funded through agreements with propagation and holding facilities.

WBS 311: 67% of the grafts completed were funded through the Forest Renewal TIP and 33% by the MOF. Most grafting was for lodgepole pine, with about 70% graft survival. Other grafting was carried out for interior spruce and interior Douglas-fir.

WBS 313: Orchard expansion continued as planned for the *Fdi NE low* SPU.

WBS 314: Ramet maintenance included only the *Fdi NE low* orchard.

Propagation

No operational rooted cutting projects were undertaken with Forest Renewal BC funding in this fiscal year.

SelectSeed Ltd. Management

SelectSeed activities in 2000/01 included:

- setting up legal, accounting, and management systems under the guidance of the SelectSeed Board of Directors
- developing a long-term Multi-Year Agreement with Forest Renewal BC to fund future orchard development
- organizing, negotiating, and managing contracts for propagation, stock holding, and future orchard development
- preparing a business plan covering SelectSeed organization, business procedures, and long- and short-term activities and budgets.

"In its first full year of operation, SelectSeed focused on staffing and developing legal, financial, and administrative infrastructure."

SelectSeed Ltd. Communication and Extension

Communication activities in 2000/01 included developing a communication plan, preparing an article for *TICtalk*, and liaising with cooperators. SelectSeed organized a tour of tree improvement facilities in the southeast United States for 10 people associated with the FGC and its working committees. The tour was partially supported by Forest Renewal BC.

FGC Program Management

FGC program management activities included developing the FGC Business Plan 2000/2001; policy, committee, issue management, and reporting for the FGC; and financial management of the Forest Renewal BC TIP.

2.6 Extension and Communication Subprogram

"The Extension and Communication Subprogram supports FGC goals and objectives through extension, communication, and education activities."

The Extension and Communication Subprogram supports FGC goals and objectives through extension, communication, and education activities. The FGC Extension Technical Advisory Committee (ETAC), which includes representatives from government and industry seed orchards, forest companies, seed dealers, academia, researchers, and consultants, prepares an annual activity plan to guide subprogram activities. The plan shapes an annual call for proposals. The ETAC reviews and ranks proposed projects based on FGC communication goals and priority messages and target audiences. The MOF Tree Improvement Branch, on behalf of Forest Renewal BC and the FGC, administers extension and communication contracts.

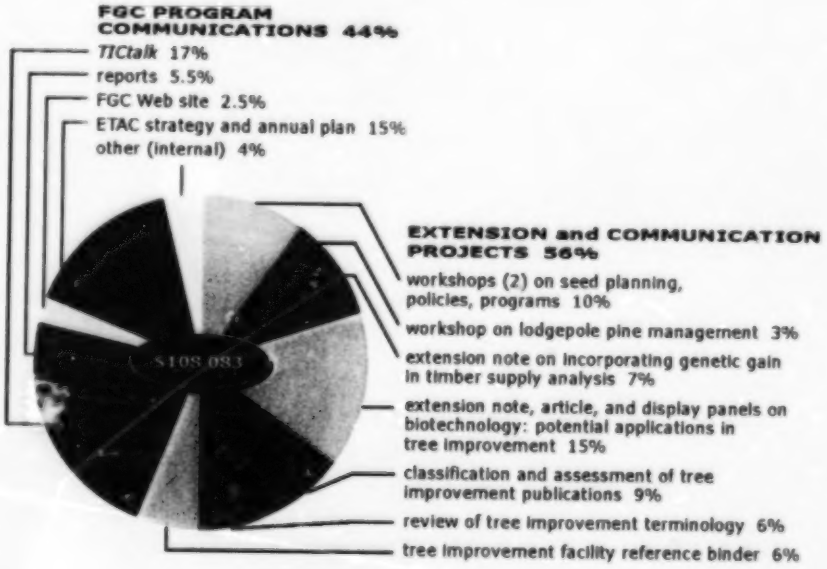

FGC PROGRAM COMMUNICATIONS 44%
TICtalk 17%
reports 5.5%
FGC Web site 2.5%
ETAC strategy and annual plan 15%
other (internal) 4%
$108 083
EXTENSION and COMMUNICATION PROJECTS 56%
workshops (2) on seed planning, policies, programs 10%
workshop on lodgepole pine management 3%
extension note on incorporating genetic gain in timber supply analysis 7%
extension note, article, and display panels on biotechnology: potential applications in tree improvement 15%
classification and assessment of tree improvement publications 9%
review of tree improvement terminology 6%
tree improvement facility reference binder 6%

Figure 12 Extension and Communication Subprogram funding allocation 2000/01.

FGC Program Communications

FGC program communications focus on activities pertinent to the provincial forest gene resource management program, such as the preparation of annual and strategic plans, reports, and brochures; development and maintenance of the FGC Web site; and production of *TICtalk*, Council's periodic newsletter. The FGC Secretariat carries out these program-level communication activities.

TICtalk expenditures in 2000/01 included completion of the 28-page Spring 2000 issue and most of the 32-page Spring 2001 issue. Support to the new ETAC included contributing to terms of reference, an extension and communication strategy, call for proposals, and development of the annual activity plan.

Extension and Communication Projects

FGC cooperators undertake a range of extension, communication, and education activities based on an annual activity plan and call for proposals.

Extension

Extension activities provide technical information and training to users, specialists, and decision-makers. In 2000/01, ETAC funded six activities:

- *Workshops (3):* One 2-day workshop on lodgepole pine pollen management and the role of pollen in seedlot rating. Two 1-day workshops on provincial seed planning, policy, and programs. Approximately 130 people, representing MOF regions and districts, consultants, and forest licensees, participated in the three workshops.
- *Extension Notes (2):* Design and development of Council's first extension notes: *Incorporating Genetic Gain in Timber Supply Analysis* and *Biotechnology: Potential Applications in Tree Improvement.*
- *Tree Improvement Facility Reference Binder.*

> "FGC cooperators completed six extension and four communication projects in 2000/01."

Communication

Communication activities include developing and disseminating information to FGC target audiences. Four products were developed in 2000/01:

- *Classification and assessment of tree improvement publications* with respect to FGC communication goals and audiences.
- *Review of tree improvement terminology* to clarify terms used by Council and its cooperators.
- *Journal article on biotechnology and its potential applications in tree improvement* for foresters and other professionals with no special training in tree improvement.
- *Panels* for the FGC display.

Education

Education activities support the development of curricula and materials in forest gene resource management for post-secondary and continuing education. No education projects were undertaken in 2000/01.

2.7 Seed Planning and Information Tools Subprogram

"The Seed Planning and Information Tools Subprogram develops computer-based information systems."

The Seed Planning and Information Tools Subprogram supports the development of computer-based systems that improve user access to information on reforestation materials. The MOF and Forest Renewal BC TIP jointly fund these projects. The Seed Information Systems Steering Committee – comprised of MOF tree improvement and systems staff, and the FGC Program Manager – identifies subprogram projects, which the Tree Improvement Branch develops and submits to the FGC for approval. The Tree Improvement Branch administers the subprogram on behalf of Forest Renewal BC and the FGC.

This two-year subprogram, which ends in 2002, will deliver Web-based applications of SPAR (Seed Planning and Registry system) and SeedMap.

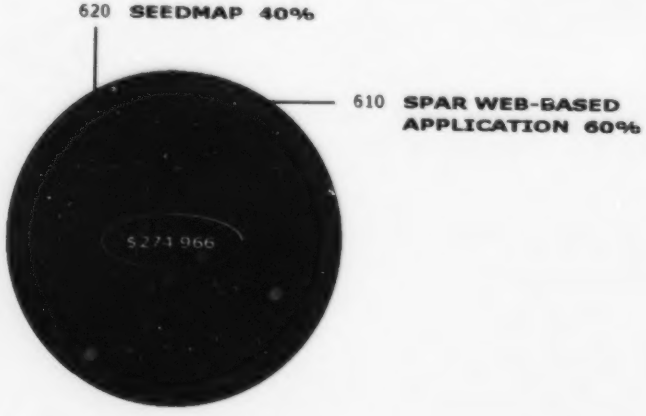


Figure 13
Seed Planning and Information Tools Subprogram funding allocation 2000/01.

SPAR Web-based Application

The SPAR project will convert the existing mainframe application and database to a Web-based application. This upgrade will simplify access to SPAR, allow users to better screen seed availability, and help MOF to track seed use across the province.

SeedMap

SeedMap will allow direct access to seed planning maps and summary reports, giving clients the tools to assess current and projected seed needs, develop appropriate cone collection and seed supply access plans, identify areas for orchard expansion, and carry out sound forest practices. SeedMap will also make it possible for clients to integrate seed planning and tree improvement information (spatial and other) with resource management initiatives such as land use planning, timber supply reviews, integrated silviculture planning, and forest certification programs.

2.8 Administration Subprogram

The Administration Subprogram provides administrative, financial, monitoring, and reporting services to the FGC and Forest Renewal BC's Tree Improvement Program.

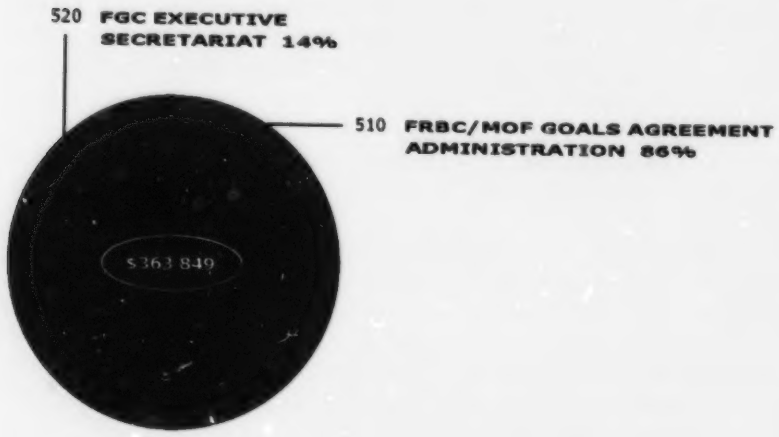


Figure 14
Administration Subprogram funding allocation 2000/01.

Forest Renewal BC/MOF Goals Agreement Administration

On behalf of the FGC and Forest Renewal BC, the Ministry of Forests provides administrative, financial, monitoring, and reporting services for the Tree Breeding, OTIP, Extension and Communication, and Seed Planning and Information Tools subprograms. These services include collecting and summarizing financial and performance reports from project proponents, and contributing to the planning and organization of FGC programs.

FGC Executive Secretariat

The FGC Executive Secretariat, whose services are contracted out through competitive bidding, supports Council's day-to-day business and planning activities. In 2000/01, these services included support to four Council meetings and several TAC meetings, representation of Council at two professional meetings, and ongoing assistance with issues management.

> *"The Administration Subprogram provides administrative, financial, monitoring, and reporting services to Council and Forest Renewal BC's Tree Improvement Program."*

3.0 Provincial Progress Indicators

Two of Council's objectives are to increase the average volume gain (genetic worth for growth, or GWg) of select seed to 12%, and to increase select seed use to 75% of total provincial sowing by 2007. Figures 15 and 16 show actual and forecast values for GWg and orchard seed/rooted cutting production for the period 1995–2009.[8]

Projections indicate that the target of 12% average GWg will be reached around 2007 (Figure 15), but that select seed use will only reach 54% by 2007 (Figure 16).

Figure 15
Actual and Species Plan forecasts of genetic worth for growth (GWg) of orchard seed/rooted cuttings.

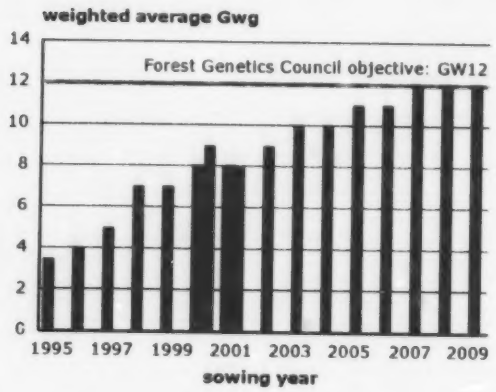
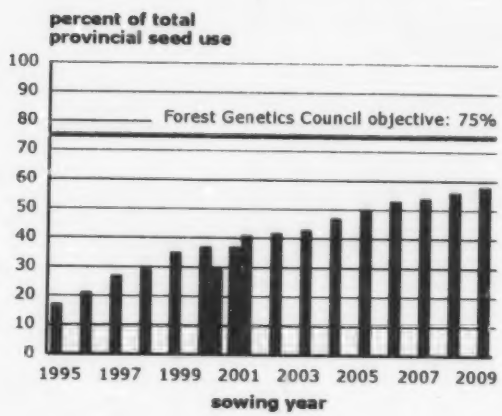


Figure 16
Actual and Species Plan forecasts of orchard seed/rooted cuttings production as percent of provincial seed use.



■ actual
■ forecast

Sowing factor adjustments are included.

Production forecasts are adjusted to the year in which seed will be available for sowing (year of production plus 1 year). "Sowing years" run from July 1 to June 30; the 2002 sowing year begins July 1, 2001.

Historic seed production and genetic worth data are from the Seed Planning and Registration (SPAR) system operated by the MOF Tree Improvement Branch.

[8] Until 2001, the term "select seed" referred to orchard seed with GW > 0. In 2001, the definition was expanded to include B+ seed (GW > 0). As a result, actual values in Figures 15, 16 for 2000 and 2001 include a small amount of B+ seed. All other values include only orchard seed.

In the near term this shortfall in use of select seed is due to poorer than expected seed production from lodgepole pine seed orchards (principally *Pli PG low, Pli NE low, Pli TO low, Pli BV low,* and *Pli CP low* SPUs), and to insufficient orchard infrastructure for two large interior spruce SPUs (*Sx PR low* and *Sx NE mid*).

After 2007, the shortfall is due mainly to the lack of breeding and orchard programs for the lodgepole pine SPUs *NE high, PG high, EK low,* and *EK high*. Total planting in these SPUs is approximately 20 million seedlings per year – about 13% of planned orchard production. A further reduction of 3 million seedlings per year will result from delayed orchard implementation associated with technical issues in the Pacific silver fir Maritime SPUs (*Ba M* all). Without programs for these SPUs, the FGC objective of 75% is unlikely to be met within the next decade.

Development of breeding and orchard programs for the four lodgepole pine SPUs have faced two major barriers: (1) uncertainty regarding the economic value of breeding and orchard programs for these SPUs and (2) insufficient MOF resources to undertake this work. A review of the data and assumptions in the Tree Improvement Investment Priority model used to evaluate and rank SPUs will be undertaken in 2001 to address the first barrier. MOF's recent hiring of a breeder to assist with interior work will partially address the second. In 2001, the Interior and Coastal TACs will review these and other SPUs that are not meeting production targets to explore additional opportunities to increase select seed production.

> *Council's target of 12% average genetic worth will be achieved around 2007.*
>
> *Significant effort is needed to increase select seed use to 75% of total provincial sowing.*

Forest gene resource management is a cooperative endeavour involving the forest industry, two levels of government, universities, and consultants.

4.0 Cooperator Activities 2000/01

The provincial forest gene resource management program involves cooperators in the forest industry, two levels of government, universities, private research companies, and individual contractors (Table 2). Many of these groups participate in the work of the Council, its TACs, and Species Committees.

The MOF is primarily responsible for tree breeding; the forest industry cooperates in identifying sites for progeny testing and with controlled matings. Private industry leads the operational production of reforestation materials – seven forest products companies, two private companies, and the provincial government own and operate seed orchards.

The CFS, MOF Research Branch, and universities undertake research supporting tree improvement, some of which is funded through the Science Council of BC and the Forest Renewal BC TIP.

Private institutions focus on applied research related to operational production, including pest control methods, pheromone monitoring, refining breeding zones and seed transfer guidelines, improving vegetative reproduction methods, understanding orchard pollination dynamics, and realized-gain trials.

The University of British Columbia (UBC) leads gene conservation activities, with input from all cooperators.

Category	Name	Orchard	Breeding	Research	Tech. Support	Policy	Planning	Gene Conserv.	Extension	Education
Government	BC Ministry of Forests	•	•	•	•	•	•	•	•	•
	Canadian Forest Service		•	•						
Universities	Simon Fraser University			•	•					•
	University of British Columbia			•	•	•	•	•	•	•
	University of Northern BC			•	•	•	•	•	•	•
	University of Victoria			•	•			•	•	•
Societies	Southern Interior Forest Extension & Research Partnership								•	
Private Companies	Ainsworth Forest Products Ltd.					•	•			
	BC Research			•	•					
	Canadian Forest Products	•	•		•		•		•	•
	CellFor			•						
	Cortex Consultants Inc.								•	
	Glenviron Consulting								•	
	Isabella Point Forestry				•		•		•	
	Pacific Regeneration Technologies	•		•	•		•		•	
	Pope and Talbot Ltd.					•				
	Riverside Forest Products	•	•		•	•	•		•	•
	Seastar Biotech			•	•					
	Timberwest Forest Corp.	•	•		•		•		•	•
	Vernon Seed Orchard Company[1]	•	•		•		•		•	•
	Western Forest Products	•	•		•		•		•	•
	Weyerhaeuser Canada	•	•		•		•		•	•
	Yellow Point Propagation	•	•		•		•		•	•
Contractors				•	•					

[1] Includes participating companies: Canadian Forest Products Ltd., The Pas Lumber Co. Ltd., Weldwood of Canada Ltd., and West Fraser Mills Ltd.

Table 2
Cooperator participation in provincial forest gene resource management program.

"In 2001/02, Council will expand its efforts in gene conservation. It will continue to promote activities that increase the production and use of select reforestation materials."

5.0 The Year Ahead

Each year brings unique challenges and opportunities. We expect those of 2001/02 to include:

- **Gene Conservation**

  The new Centre for Forest Gene Conservation at UBC will focus conservation activities, expand the scope of the provincial forest gene resource management program, and support forest products certification. Watch for British Columbia to become a world leader in this important area, and to better integrate conservation with breeding and seed production programs.

- **Replacement of Retiring Councillors**

  Several Councillors will be retiring after their three-year term of service and significant contribution to the provincial forest gene resource management program and Forest Renewal BC's Tree Improvement Program. In seeking their replacements, Council will look for new members with an equal commitment to program implementation.

- **Strategic and Business Planning**

  Council's strategic and annual business plans provide the foundation for funding by Forest Renewal BC, Ministry of Forests, and industry. In the coming year, the Strategic Plan will be updated and business planning will continue to improve with more reliable and readily available data, formalization of committee processes, and increased participation from cooperators around the province. Better planning will, in turn, improve the coordination of work carried out by breeding, orchard, and technical support staff.

- **Seed Planning and Information Tools**

  Development of Web-based seed planning and information systems will near completion in 2002. SeedMap, which will provide Web-based access to seed planning maps, spatial information, and attribute data will be pilot tested early in the 2001/02 fiscal year. The conversion of SPAR to a Web application and Oracle database is scheduled for implementation in June 2002.

- **Incorporating Genetic Gain in Timber Supply**

  The main economic reason for undertaking tree improvement activities is to increase timber supply and improve timber quality. Tree improvement investment decisions should, therefore, be based on how the activities affect timber supply.

To incorporate genetic gain in timber supply analysis requires knowing the genetic gain of select seed, how much will be available, and where it will be used; and projecting the yield of stands established from select seed.

Important advances have been made recently in all these areas. It is anticipated that in the year ahead genetic gain will be routinely incorporated in timber supply analyses supporting AAC determination and operational planning.

- **Biotechnology in Tree Improvement**

The forest sector, like agriculture and medicine, is under pressure from a range of publics regarding the use of biotechnology, and genetic engineering in particular. The future of biotechnology in the production of reforestation materials in British Columbia remains uncertain. The greatest challenges may be ethical. Current research is focused on the application of biotechnology to improve and support traditional tree breeding and seed production methods. No genetically engineered materials are planted in British Columbia forests.

> *"Council will explore social and ethical issues related to the use of biotechnology in tree breeding and seed production."*

Over the next couple of years, Council will explore the social and ethical issues related to the use of biotechnology. In the spring of 2001, Council initiated a multi-disciplinary group of geneticists, ethicists, and policy makers to begin discussions about this topic and its policy implications for the province. The Extension TAC has allocated funds in 2001/02 for a problem analysis on the use of biotechnology in tree improvement to provide a framework for fruitful discussions.

- **Certification**

Certification of forest products has become an accepted and influential factor in forest management and forest products manufacturing around the world. Certification will increasingly affect forest management practices, including the use of select seed.

Existing MOF seed-use policy includes provisions for gain, genetic diversity, and adaptability. However, certification requirements may influence the amounts and types of select seed used by forest licensees. The provincial forest gene resource management program, with its emphasis on seed transfer requirements, genetic diversity, and gene conservation, provides an excellent foundation for responding to certification initiatives.

Appendix 1: Seed Planning Units

Seed planning units (SPUs) – unique combinations of species, seed planning zone (SPZ), and elevation band – are the basis for breeding and seed production planning in the provincial forest gene resource management program.

The following table lists the 43 SPUs in the FGC provincial forest gene resource management program; SPU #38 is merged with SPU #3 to create 42 SPUs for planning. SPUs are ranked for investment based on the direct economic benefits derived from increased harvest due to tree improvement activities. Species Plans for each SPU are set out in the annual FGC Business Plan.

Seed planning unit (SPU)				
#	Species	SPZ	Elevation band (m)	
1	Fdc	M	low	(< 700)
2	Cw	M	low	(< 600)
3	Hw	M	low	(< 600)
4	Sx	NE	mid	(1000-1500)
5	Sx	NE	high	(> 1500)
6	Ss	M	low	(< 750)
7	Pli	NE	low	(< 1400)
8	Pw	M/SM	low	(< 1000)
9	Ba	M	low	(< 1000)
10	Pli	TO	low	(< 1400)
11	Yc	M	all	(< 1200)
12	Pli	PG	low	(< 1200)
13	Lw	NE	low	(< 1300)
14	Sx	PG	low	(< 1200)
15	Pw	KQ	all	(< 1400)
16	Pli	TO	high	(> 1400)
17	Pli	BV	low	(< 1200)
18	Pli	CP	low	(< 900 N of 56° ; < 1100 S of 56°)
19	Fdc	SM	low	(200-1000)
20	Pli	NE	high	(> 1400)
21	Fdi	NE	low	(< 1000)
22	Fdi	NE	high	(> 1000)
23	Sx/Ss	SM/NST	all	
24	Hw	M	high	(> 600)

Seed planning unit (SPU)				
#	Species	SPZ	Elevation band (m)	
25	Sx	EK	all	(< 1700)
26	Pli	PG	high	(> 1200)
27	Cw	SM	low	(200-1000)
28	Sx	TO	high	(1300-1850)
29	Pli	EK	high	(> 1500)
30	Sx	TO	low	(< 1300)
31	Fdc	M	high	(> 700)
32	Pli	EK	low	(< 1500)
33	Cw	M	high	(> 600)
34	Lw	EK	all	(800-1500)
35	Sx	BV	low	(< 1200)
36	Bg	M	low	(< 700)
37	Fdi	QL	low	(< 1200)
38	Hw	M	low	(< 600)
39	Fdi	EK	all	
40	Sx	PR	low	(< 1200)
41	Fdi	PG	low	(< 1000)
42	Sx	PG	high	(> 1200)
43	Fdi	CT	low	(< 1100)

Forest Genetics Council of BC

Name	Affiliation	Representing
Shane Browne-Clayton	Riverside Forest Products	Industry Co-Chair
Dr. Dale Draper	Ministry of Forests	Ministry of Forests Co-Chair
Dr. Sally Aitken	University of BC	Coastal Technical Advisory Committee
Dr. John Barker	University of BC	Coast industry
Henry Benskin	Ministry of Forests	Forestry Division, Research Branch
Dr. Michael Carlson	Ministry of Forests	Interior Technical Advisory Committee
Janet Gagne	Forest Renewal BC	Forest Renewal BC
Dr. Chris Hawkins	University of Northern BC	University
Mark Hopkins	Ainsworth Forest Products	Interior industry
Art Lacourciere	Weldwood Canada	Interior industry
Diane Medves	Weyerhaeuser Canada	Coast industry
Ray Schultz	Ministry of Forests, Prince George	Operations Division

Coastal Technical Advisory Committee

Name	Affiliation	Name	Affiliation
Dr. Sally Aitken (Chair)	University of BC	Gerry Pinkerton	Ministry of Forests
Patti Brown	Canadian Forest Products	David Reid	Ministry of Forests
Tim Crowder	TimberWest Forests	Dr. John Russell	Ministry of Forests
Dr. David Cyr	Cellfor Ltd.	Larry Sigurdson	Ministry of Forests
Dr. John King	Ministry of Forests	Dr. Michael Stoehr	Ministry of Forests
David Kolotelo	Ministry of Forests	Annette Van Niejenhuis	Western Forest Products
Diane Medves	Weyerhaeuser	Dr. Alvin Yanchuk	Ministry of Forests
Don Pigott	Yellow Point Propagation		

Interior Technical Advisory Committee

Name	Affiliation	Name	Affiliation
Dr. Michael Carlson (Chair)	Ministry of Forests	Clare Kooistra	Ministry of Forests
David Basaraba	Crestbrook Forest Industries	Tim Lee	Vernon Seed Orchard Co.
Shane Browne-Clayton	Riverside Forest Products	Mike Madill	Ministry of Forests
Keith Cox	Ministry of Forests	Russ Martin	Canadian Forest Products
Nola Daintith	Ministry of Forests	Anna Monetta	Ministry of Forests
Mark Faliszewski	Ministry of Forests	George Nicholson	Riverside Forest Products
Hilary Graham	Pacific Regeneration Technologies	Gerry Pinkerton	Ministry of Forests
Terry Hammond	Pope & Talbot	Chris Walsh	Ministry of Forests
Dr. Chris Hawkins	University of Northern BC	Joe Webber	Ministry of Forests
Barry Jaquish	Ministry of Forests	Kim Young	Tolko Industries

Extension Technical Advisory Committee

Name	Affiliation	Name	Affiliation
Dr. Chris Hawkins (Chair)	UNBC	Don Pigott	Yellow Point Propagation
Charlie Cartwright	Ministry of Forests	Doug Stables	Western Forest Products
Keith Cox	Ministry of Forests	Don Summers	Ministry of Forests
Tim Crowder	TimberWest	Kathie Swift	SIFERP
Peter Forsythe	The Pas Lumber	Dave Trotter	Ministry of Forests
Diane Gertzen	Ministry of Forests	Eric van Steenis	Ministry of Forests
Lauchlan Glen	Glenviron Consulting	Dr. Joe Webber	Ministry of Forests
Melissa Hadley	FGC Secretariat	**Alternates**	**Affiliation**
Tim Lee	Vernon Seed Orchard Company	Jordan Tanz	FGC Secretariat
George Nicholson	Riverside Forest Products	Steve Thorpe	Canadian Forest Products

Gene Conservation Technical Advisory Committee

Name	Affiliation
Dr. Sally Aitken (Chair)	UBC
Dr. Dale Draper	Ministry of Forests
Jack Woods	SelectSeed Ltd.
Dr. Alvin Yanchuk	Ministry of Forests
Dr. Cheng Ying	Ministry of Forests